

SOCIETY FOR THE ENCOURAGEMENT OF  
ARTS, MANUFACTURES, & COMMERCE.

(13)

**Report of the Committee**

**LEATHER FOR BOOKBINDING.**

WITH FOUR APPENDIXES:

1. *Report of Sub-Committee, No. I.*
2. *Report of Sub-Committee, No. II.*
3. *Hints to Owners and Keepers of Libraries.*
4. *Circular to Librarians and Replies.*

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PATRON - - HIS MAJESTY KING EDWARD VII.

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SOCIETY FOR THE ENCOURAGEMENT OF  
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**Report of the Committee**

ON

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# REPORT OF THE COMMITTEE ON LEATHER FOR BOOK-BINDING.

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of the Council of the Society of Arts.

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man of the Committee.

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DOUGLAS COCKERELL (Bookbinder).

CYRIL DAVENPORT, F.S.A. (British Museum  
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E. GORDON DUFF (late of The John Rylands  
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SIEGMUND HERMANN EPSTEIN (Leather  
Manufacturer).

ERNEST FULLER (Messrs. Bevington and  
Sons, Leather Manufacturers).

RICHARD GARNETT, C.B., LL.D. (late  
Keeper of the Department of Printed Books,  
British Museum).

WALTER JAMES LEIGHTON (Bookbinder).

THE RIGHT HON. SIR HERBERT MAXWELL,  
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J. GORDON PARKER, Ph.D. (Director of the  
London Leather Industries Research Labo-  
ratories, Herold's Institute, Bermondsey).

WILLIAM HENRY PERKIN, LL.D., Ph.D.,  
F.R.S. (Past-master of the Leathersellers'  
Company).

MISS S. T. PRIDEAUX (Bookbinder).

PROFESSOR HENRY RICHARDSON PROCTER,  
F.I.C. (Professor of Leather Industries at  
the Yorkshire College, Leeds).

A. SEYMOUR-JONES (Leather Manufacturer,  
Wrexham).

ROBERT STEELE (Assistant - Secretary and  
Librarian of the Chemical Society).

JOSEPH ZAEHNSDORF (Bookbinder).

SIR HENRY TRUEMAN WOOD, M.A., Secre-  
tary of the Society of Arts.

## REPORT.

The decay of leather used for bookbindings has for long been a subject which has attracted a great deal of attention and interest amongst librarians and book collectors. The first attempt which was made to investigate the conditions leading to such decay appears to have been made by Faraday, whose historic researches into the condition of the library of the Athenæum Club in 1842 still remain the only serious attempt made to investigate this subject.\* Of late years the matter has received

still more earnest attention owing to a growing belief among librarians that the quality of the leathers now made for bookbinding purposes is inferior to that made previous to, say, the middle of the last century. The matter has been discussed on several occasions at meetings of the Library Association, and about two years ago a meeting of persons specially interested in the question was held at the Central School of Arts and Crafts in Regent-street, under the chairmanship of Mr. Cobden-

\* Professor Faraday delivered a lecture on "Light and Ventilation," at the Royal Institution, on April 7th, 1843, which was chiefly devoted to the consideration of the ventilation of lighthouses: in the latter part of the lecture, however, allusion was made to the ventilation of the Athenæum Club. "His new mode of ventilating burners of lamps" is thus described. It "consists in using two glass chimneys, one within the other, the outer one being covered by a sheet of mica, and the products of combustion pass up

the interior glass chimney, and then pass down inside the outer glass chimney, the products of combustion being then received into a pipe which carries them into the outer atmosphere." Mr. James Faraday read a paper before the Institution of Civil Engineers on June 13th, 1843, entitled: "Description of a mode of obtaining the perfect ventilation of Lamp-Burners." (Proceedings of the Institution, vol. ii. p. 184.) Professor Michael Faraday spoke in the discussion that followed the paper.



Sanderson. This meeting formed itself into a Committee to encourage the production of sound and durable leather for bookbinding. The Committee held several meetings, and some of its members carried out a good deal of investigation and experiment, but it appears to have come to the conclusion that the matter was too large a one to be dealt with by a separate and informal body of the sort, and it was decided to request the Council of the Society of Arts to undertake a thorough investigation of the whole question, and, after having done so, to issue a Report upon it.

In February, 1900, the Council of the Society of Arts acceded to this request, and appointed a Committee, with instructions to enquire fully into the subject, and to report on the durability of the leathers now used for the purpose of binding books. This Committee met for the first time on the 3rd of May, 1900, when Lord Cobham was elected as Chairman. Its first step was to appoint two Sub-Committees from amongst its members. The first of these was to visit a selected number of libraries, and to ascertain the comparative durability of the various bookbinding leathers used at different periods and preserved under different conditions. This Sub-Committee was composed of the following members:—Mr. Cyril Davenport, Dr. J. Gordon Parker, Mr. A. Seymour-Jones, Mr. W. J. Leighton, and Mr. Douglas Cockerell. The second Sub-Committee—consisting of Dr. J. Gordon Parker, Professor Henry R. Procter, and Mr. A. Seymour-Jones—was appointed to deal with the scientific side of the matter, to ascertain the cause of any deterioration noticed, and, if possible, to suggest methods for its prevention in the future.

The Reports of the two Sub-Committees are printed as appendixes. They contain the details of the work of the Committee which is summarised in the general Report. Reference should in all cases be made to the appendixes for special and detailed information.

The Report of the first Sub-Committee forms Appendix I. The first step taken by the Sub-Committee was to visit a number of libraries, including that of the British Museum, the Bodleian Library, Oxford, the University Library Cambridge, the libraries of the Athenæum Club, of the Patent Office, and of the Chemical Society, also the valuable private library of Mr. Huth. The objects they set before them in their investigation were to ascertain if the complaints of the premature decay of modern bookbinding

leathers are justified by facts, and, if so, to ascertain at about what date leather began noticeably to deteriorate; to find out, by noticing the conditions under which the books were kept, the effect of its environment on the durability of the leather; to decide on the relative suitability of various leathers for bookbinding; to suggest practicable methods by which the quality of the leather can be improved; and to decide on the best conditions under which books can be kept. Part of this work was afterwards delegated to the second Sub-Committee, and indeed it was not always possible to keep entirely distinct the work of the two Sub-Committees. On some points they were worked together. Some slight overlapping may be found in the two Reports, but on the whole it will be found that the original division of labour has been fairly well preserved.

As regards the common belief that modern binding leather does decay prematurely, the Sub-Committee satisfied themselves that books bound during the last eighty or hundred years showed far greater evidence of deterioration than those of an earlier date. Many recent bindings showed evidence of decay after so short a period as ten, or even five years. The Sub-Committee came to the conclusion that there is ample justification for the general complaint that modern leather is not so durable as that formerly used. To fix the date of the commencement of this deterioration was a difficult matter; but they came to the conclusion that while leather of all periods showed some signs of decay, the deterioration becomes more general on books bound after 1830, while some leathers seem to be generally good until about 1860, after which date nearly all leathers seem to get worse. The deterioration of calf bindings at the latter end of the nineteenth century may be attributed as much to the excessive thinness as to the poor quality of the material.

With regard to the conditions under which books are kept, ventilation, lighting, heating, &c., the Committee were satisfied that in libraries in which there was no artificial light used, and where the ventilation was good, the bindings were generally in a better state than elsewhere. Where gas is used the bindings are in the worst state noticed, especially on the higher shelves. Books kept in much used rooms are generally in a bad state—though whether it is really due to gas or other fumes cannot be decided. Tobacco smoke is certainly injurious. Daylight, and still more direct sun-

light, has a disintegrating effect on leather. Books kept in cases with closely fitting doors, are generally in a better condition than those exposed directly to the atmosphere. Where, however, owing to the dampness of the walls, or other causes, moisture obtained admission to such cases, the books then suffered more than if they were in a well-ventilated place.

As to the suitability of various leathers, the Sub-Committee came to the conclusion that of the old leathers (15th and 16th century), white pigskin, probably alum tanned, is the most durable, but its excessive hardness and want of flexibility renders this leather unsuitable for most modern work. Old brown calf has lasted fairly well, but loses its flexibility, and becomes stiff and brittle when exposed to light and air. Some of the white tawed skins of the 15th and 16th century, other than white pigskin, and probably deerskin, have lasted very well. Some 15th and 16th century sheepskin bindings have remained soft and flexible, but the surface is soft and usually much damaged by friction. Vellum seems to have lasted fairly well, but is easily influenced by atmospheric changes, and is much affected by light. Early specimens of red morocco from the 16th to the end of the 18th century were found in good condition, and of all the leathers noticed, this seems to be the least affected by the various conditions to which it had been subjected. In the opinion of the Committee, most of this leather has been tanned with sumach or some closely allied tanning material. Morocco bindings earlier than 1860 were generally found to be in fairly good condition, but morocco after that date seems to be much less reliable, and in many cases has become utterly rotten. During the latter part of the 18th century it became customary to pare down calf until it was as thin as paper. Since about 1830 hardly any really sound calf seems to have been used, as, whether thick or thin, it appears generally to have perished. Sheepskin bindings of the early part of the century are many of them still in good condition. Since about 1860 sheepskin as sheepskin is hardly to be found. Sheepskins are grained in imitation of other leathers, and these imitation-grained leathers are generally found to be in a worse condition than any of the other bindings, except, perhaps, some of the very thin calfskin. Undyed modern pigskin seems to last well, but some coloured pigskin bindings had entirely perished. Modern leathers dyed with the aid of sulphuric acid are all to be condemned. In

nearly every case Russia leather was found to have become rotten, at least in bindings of the last fifty years.

On the whole, the Committee came to the conclusion that a pure sumach tannage will provide a good and durable leather, and that leather may be produced which will prove as durable as any made in the past. The Committee also came to the conclusion that the bookbinder must share with the leather manufacturer and librarian the blame for much of the premature decay of leather bindings. The objections which the Committee take to modern bindings are set out in the appendix, where will also be found two suggested specifications, one for binding heavy or valuable books, and one for ordinary library binding.

At the suggestion of the Sub-Committee a circular was sent to 119 librarians throughout the country, asking for information as to the effect of bookbindings showing deterioration, as to the conditions under which books were kept in the different libraries, and for the opinions of the librarian as to the class of leather he considered the best for bookbinding. A copy of the circular letter issued, a list of the libraries sending answers, and a tabular statement embodying the information received, will be found in Appendix IV.

The work of the second Sub-Committee, which was composed of chemists specially conversant with the treatment of leather, was directed specially to the elucidation of the following points: an investigation of the nature of the decay of leather used for bookbinding; an examination of the causes which produced this decay; a research into the best methods of preparing leather for bookbinding; and a consideration of the points required to be dealt with in the preservation of books.

Taking these points in order, the first one dealt with is the question of the nature of the decay of leather. To arrive at their conclusions on this subject, the Sub-Committee made a number of tests and analyses of samples of decayed leather bookbindings, as well as of leathers used for binding. The Committee found that the most prevalent decay was what they term a red decay, and this they think may be differentiated into old and new, the old red decay being noticeable up to about 1830, and the new decay since that date. In the old decay, the leather becomes hard and brittle, the surface not being easily abraded by friction. The older form is specially noticeable in calf-bound books,



tanned presumably with oak bark. The new form affects nearly all leathers, and in extreme cases, seems absolutely to destroy the fibres. Another form of deterioration, more noticeable in the newer books, renders the grain of the leather liable to peel off when exposed to the slightest friction. This is the most common form of decay noted in the most recent leathers. In nearly all samples of Russia leather a very violent form of red decay was noticed. In many cases the leather was found to be absolutely rotten in all parts exposed to light and air, so that on the very slightest rubbing with a blunt instrument the leather fell into fine dust. It appears to be a general opinion that leather, and especially Russia leather, lasts better on books that are in constant use. This is attributed to the slight amount of grease absorbed by the leather from the hand, and it is suggested that possibly a suitable dressing may be discovered which would have a similar effect on the leather, as is produced by this grease. It was decided that experiments extending over a length of time would be necessary.

The second point is the cause of the decay. An extensive series of experiments was carried out with a view of determining the causes of the decay of bindings. The Sub-Committee find that this is caused by both mechanical and by chemical influences. Of the latter some are due to mistakes of the leather manufacturer and the bookbinder, others to the want of ventilation, and to improper heating and lighting of libraries. In some cases inferior leathers are finished (by methods in themselves injurious) so as to imitate the better class leathers, and of course where these are used durability cannot be expected. But in the main the injury for which the manufacturer and bookbinder are responsible must be attributed rather to ignorance of the effect of the means employed to give the leather the outward qualities required for binding, than to the intentional production of an inferior article. Details of this part of the subject will be found in the report of the Sub-Committee in Appendix II. Here it may be sufficient to state that in addition to the injury to leather often caused by the treatment in the earlier stages of preparation, leathers produced by different tanning materials, although they may be equally sound and durable mechanically, vary very much in their resistance to other influences, such as light, heat, and gas fumes.

For bookbinding purposes, the Sub-Com-

mittee generally condemn the use of tanning materials belonging to the catechol group, although the leathers produced by the use of these materials are for many purposes excellent and indeed superior. The class of tanning materials which produce the most suitable leather for this particular purpose belong to the pyrogallol group, of which a well-known and important example is sumach. East Indian or "Persian" tanned sheep and goat skins, which are suitable for many purposes, and are now used largely for cheap bookbinding purposes, are considered extremely bad. Books bound in these materials have been found to show signs of decay in less than twelve months, and the Sub-Committee are inclined to believe that no book bound in these leathers, exposed on a shelf to sunlight or gas fumes, can ever be expected to last more than five or six years. Embossing leather under heavy pressure to imitate a grain has a very injurious effect, while the shaving of thick skins greatly reduces the strength of the leather by cutting away the tough fibres of the inner part of the skin. The use of mineral acids in brightening the colour of leather, and in the process of dyeing, has a serious effect in lessening its resistance to decay. A good deal yet remains to be learned about the relative permanency of the different dyes.

Next to the causes of decay due to the original treatment of the leather come the conditions to which the book is exposed in the library. To try these a very careful series of tests was made. Leathers were exposed under various conditions to gas fumes, to light (sunlight, gaslight, and electric light), and to heat. As the result of these experiments, the Sub-Committee consider that of the deleterious influences to which books are subjected, the fumes of burnt gas are the most fatal. The results of the experiments of exposing leathers to light of various colours was somewhat unexpected. It was found that leathers of a different character act in very different ways—some are bleached or darkened very rapidly by the action of direct sunlight, others resist for a longer period. Most leathers, however, appear to be affected, not only in colour, but in their actual substance. As regards sunlight, experiments were made by exposing the leathers under differently coloured glasses, and a simple test is proposed for the character of the light most suitable for libraries, as it is found that the action of light upon leather is quite comparable with the action of light upon



ordinary photographic printing paper. Glass which is to be used for glazing library windows can therefore be tested by trying its action on such a material as ordinary photographic paper, and it is suggested that all library windows which are exposed to the direct rays of the sun ought to be glazed with glass of a slight yellow or olive tint, so as to exclude as much as possible the more chemically active rays. It was also found that a darkening action was produced by exposure to artificial light, though it is not quite certain how far the effects observed were not partially due to the radiant heat. So far as the Sub-Committee were able to ascertain, these effects were not so much due to the effect of oxidation as to the action of light, warmth, and moisture. The effect of ammonia fumes was very marked, and tobacco smoke was also found to have a similar darkening and deleterious effect, so much so that the Sub-Committee have no doubt that the deterioration of bindings in a library where smoking is carried on is partly due to this cause.

On the whole, the Sub-Committee are satisfied that of all the influences of which books are exposed in libraries, gas fumes—no doubt because of the sulphuric and sulphurous acid which they contain—are shown to be the most injurious, but light, and especially direct sunlight and hot air, are shown to possess deleterious influences which had scarcely been suspected previously, and the importance of moderate temperature and thorough ventilation of libraries cannot be too much insisted on.

The conclusions at which the Committee have arrived, may be summarised as follows:—

1. They consider that the general belief that modern bookbinding leather is inferior to that formerly used, is justified, and that the leather now used for binding books is less durable than that employed fifty years ago, and at previous times. They believe that there ought to be no difficulty in providing leather at the present time as good as any previously made, and they hope that the instructions laid down in the report of the Sub-Committee, printed as Appendix II, will result in the production of such leather.

2. They think that the modern methods of bookbinding are, to some extent, answerable for the lessened permanence of modern bindings. The practice of shaving down thick skins is a fruitful source of deterioration. They think that the adoption of the method of binding recommended in the report of the Sub-

Committee, printed as Appendix I, ought to result in a greater permanence of the books treated.

3. They consider that the conditions under which books are best preserved, are now fairly well understood, except that the injurious effect of light on leather has not previously been appreciated. They are satisfied that gas fumes are the most injurious of all the influences to which books are subjected. They consider that with proper conditions of ventilation, temperature, and dryness, books may be preserved without deterioration, for very long periods, on open shelves, but that there is no doubt that, as a general rule, tightly fitting glass cases conduce to their preservation.

4. The Committee have satisfied themselves that it is possible to test any leather in such a way as to guarantee its suitability for book-binding. They have not come to any decision as to the desirability of establishing any formal or official standard, though they consider that this is a point which well deserves future consideration.

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## APPENDIX I.

### REPORT OF SUB-COMMITTEE, NO. I.

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Cyril Davenport, Dr. J. Gordon Parker, A. Seymour-Jones, W. J. Leighton, Douglas Cockerell.

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This Sub-Committee was appointed to visit libraries and to ascertain the comparative durability of the various bookbinding leathers used at different periods and preserved under different conditions.

### THE LIBRARIES VISITED AND THE REASONS FOR SELECTION.

Mr. Huth's Library.—A private library of valuable books expensively bound and very well kept. Books under clear glass not against the wall; hot air, even temperature, good ventilation, translucent, or tinted glass.

Chemical Society.—A library largely consisting of sets of transactions and periodicals bound as each year was completed, so that the approximate date of most of the binding could be ascertained. The binding in this library is typical of that in most society and club libraries.

Athenæum Club.—Open fires in some rooms ; gas until 1890, electric light since. A library distributed through rooms that are a great deal used for the purposes of the club, smoking being permitted in some. The binding is generally of a more expensive-kind than at the Chemical Society. It was in this library that Faraday conducted his experiments on the injurious effect on leather bindings of the fumes of burnt gas.

British Museum.—Library without gas where bindings of various dates could be compared.

Patent Office.—A very much used library in which gas has been used until lately, and where the condition of the binding had been reported to be very bad.

Oxford and Cambridge.—Libraries in comparatively pure air, where no gas has been used, and where there are large numbers of books that have occupied the same places in the shelves for very long periods.

In addition to these, other libraries were visited by various single members of the committee.

The aim of the Sub-Committees was—

I.—To ascertain if the complaints of the premature decay of modern bookbinding leathers are justified by facts.

And if so—

II.—By comparing bindings of different times to ascertain at about what date the leather began noticeably to deteriorate in quality.

III.—By noting the conditions of ventilation, lighting (natural and artificial), heating, &c., in different libraries, and comparing the states of bindings in them ; to ascertain the effect of environment on the durability of the leather.

IV.—By noting the state of various books bound in various leathers at about the same time and kept under similar conditions ; to ascertain the relative suitability of the various leathers for book-binding.

V.—To ascertain how far faulty construction is responsible for the want of durability of modern leather bindings.

In addition to these the following points were dealt with in collaboration with Sub-Committee No. II. The results of their enquiries are embodied in the report of that Sub-Committee.\*

VI.—To ascertain the nature and special causes of the various kinds of deterioration noticed.

VII.—To suggest practicable methods by which the quality of the leather can be improved, the stability of the binding insured, and the dangerous effects of light, heat, and other external influences in libraries minimised.

The opinion formed by the Committee on these points and the reasons for forming it are given in order.

I.—*If the complaints of the Premature Decay of modern Binding Leather are justified by facts.*

In every library visited the Committee found evidence of decay of bindings of all periods represented, but the books bound during the last 80 to 100 years showed far greater evidence of deterioration than those of an earlier date. Very many recent bindings examined showed evidence of the decay of the leather after as short a period as from five to ten years.

On these grounds the Sub-Committee is of opinion that there is ample justification for the very general complaints—that modern book-binding leather is not as durable as that formerly used.

II.—*By comparing Bindings of Different Times to ascertain at about what date the Leather began noticeably to deteriorate in quality.*

The Sub-Committee had considerable difficulty in fixing the date of the beginning of the deterioration of modern bookbinding leather. While leather of all periods shows some signs of decay, the deterioration becomes more general on books bound after about 1830.

The calf bindings of the fifty years previous to this date show marked deterioration, but this seems to be as much due to the excessive thinness as to the poor quality of the leather. Some leathers seem to be generally good until about 1860, and after about that date nearly all leathers seem to get worse.

III.—*By noting the conditions of Ventilation, Lighting (natural and artificial), Heating, &c., in different Libraries, and comparing the state of Bindings in them ; to ascertain the effect of environment on the durability of the Leather.*

1. It was noted by the Committee that in libraries in which there was no artificial light

\* See Appendix II.



used, and where ventilation was good, the bindings were generally in a better state than elsewhere. (In some country libraries carefully kept the binding showed very little decay.)

2. That in libraries where gas is, or has been used, the bindings are in the worst state noticed, especially on the higher shelves.

3. That books kept in much used rooms are in a bad state. (Tobacco smoke is injurious.)

4. That ordinary daylight has a disintegrating effect on *certain* leathers. Direct sunlight acts more rapidly, and, according to the almost unanimous opinion of the Committee, affects all leathers injuriously. In the opinion of one member of the Committee this is not always the case. He states that he has many examples of the colours being bleached without the leathers suffering, and suggests as the cause of decay the variations of temperature brought about by the direct action of the sun.

5. That in cases where books have been allowed to become and remain in a very dusty condition, the leather had perished.

6. That books kept on book-shelves with glass or other closely fitting doors are generally in a far better condition than those exposed directly to the atmosphere. On the other hand, where exceptional conditions prevail, such as damp on the one hand or excessive dryness on the other, the absence of ventilation in well-made, close-fitting cases, may be a positive evil.

IV.—*By noting the state of various books bound in different Leathers at about the same time and kept under similar conditions; to ascertain the relative suitability of the various Leathers for Bookbinding.*

Of the old leathers (15th and 16th centuries) white pigskin, probably alum tanned, has proved to be by far the most durable, but its excessive hardness and want of flexibility renders this leather, as prepared at that time, unfit for most modern work.

Old brown calf seems to have lasted fairly well, but shows a tendency to lose its flexibility and become very stiff and brittle where exposed to light and air.

Old calf books (1475-1530) with wooden boards seem to have lasted better than others with boards of paper or mill-board, which perhaps more easily absorb damp.

Some of the white tawed skins of the 15th and 16th centuries, other than the white pigskin, and probably deerskin, have lasted very well.

Some coltskin noticed, of the 15th century, was still in very good condition.

Some 15th and 16th century sheepskin bindings have remained quite soft and flexible, but the surface is usually much damaged by friction.

Vellum seems to have lasted fairly well where not exposed for long periods to light, but it is so easily influenced by atmospheric changes as to make it rather an unsatisfactory binding material. It was noticed that where vellum binding had remained on shelves for long periods the side nearest the light had in some cases become as brittle as egg-shell. The side away from the light remained sound.

From the 16th to towards the end of the 18th century specimens of red morocco were found to be in good condition. Of all the leather noticed, this seemed to be least changed by the various conditions to which it had been subjected. It retains its flexibility and colour to a remarkable extent, keeping a hard surface that was not easily damaged by friction. In the opinion of the Committee, most of this leather has been tanned with sumach or some closely allied tanning material.

At the end of the 18th century and the beginning of the 19th, a red and straight-grained morocco came into general use. This is probably sumach tanned and dyed with cochineal. This leather has lasted remarkably well, as has also, though apparently not so much used, a green straight-grained morocco of the same nature.

During the latter part of the 18th century it became customary to pare down calf for book-binding purposes until it was as thin as paper. This, as might have been expected, has broken at the joints in nearly every case. After about 1830 and until the present time, hardly any really sound calf seems to have been used, as, whether thick or thin, it has nearly all perished, turning red and crumbling to dust. Sprinkled or marbled calf books are in a specially bad state.

The morocco bindings seem to have been fairly good until about 1860, but after that date very many have become utterly rotten, showing signs of red decay, or of the grain peeling off at the slightest friction.

Sheepskin bindings of the early part of the century are many of them still in good condition. Sheepskin, in a fairly natural state, seems to keep its flexibility, but it is very easily damaged by friction. Since about 1860 sheepskin as sheepskin is hardly to be found. We have instead sheepskins grained in imita-



tion of various other leathers, and these imitation grained leathers are, generally speaking, in a worse condition than any we have seen, excepting perhaps some of the very thin calf-bindings.

Modern pigskin, if genuine, seems to have lasted very well when in an undyed condition; but some coloured pigskin bindings were found to have utterly perished. Pigskin is naturally a hard, rather stiff leather, and is suitable for large books rather than small. If submitted to severe softening processes in manufacture its durability is very small.

Quite modern leather dyed black seems, in nearly all cases, to have perished, although old black morocco (16th, 17th, and 18th centuries) in good condition is not uncommon.

*Russia leather* in nearly every case was found to have become utterly rotten. It was stated that if Russia books were very much handled the leather lasted well enough, but when left undisturbed on the shelves it rapidly crumbled to dust. Some Russia leather of the time of the early 19th century on large books, *i.e.*, when not pared down too much has lasted perfectly, but it appears to be a different material from that used now, with a well defined grain.

It is the opinion of the Committee, that the ideal bookbinding leather must have and retain great flexibility. It was noticed generally that in the case of the old bindings the joints had broken on account of the leather becoming stiff and hard, or on account of the bad working of the end papers and the heavy leverage of the boards. Bookbinding leather must have a firm grain surface, not easily damaged by friction. It was noticed that soft and spongy leathers became very shabby. A bookbinding leather should not be artificially grained. It was noticed that in cases of the old leathers that had lasted best no attempt had been made to remove the tan pit marks, and that modern leathers, with embossed or plated grain, were generally in a very bad condition.

The Committee is of opinion that a pure sumach tannage will answer all these conditions, and that leather can and will be now produced that will prove to be as durable as any made in the past.

It was noticed that leather bindings that had been coated with glair or varnish were in a better state than those without.

Librarians stated that leather bindings that are much used last better than those that are left undisturbed on the shelves.

*VI.—To ascertain how far Faulty Construction is responsible for the want of Durability of Modern Leather Bindings.*

The investigations of the Sub-Committee serve to show that the bookbinder must share, in no small measure with the leather manufacturer and librarian, the blame for the premature decay of leather bindings.

The Committee noticed that:—

1. Books are sewn on too few, and too thin cords, and that the slips are pared down unduly (for the sake of neatness), and are not in all cases firmly laced into the boards. This renders the attachment of the boards to the book almost entirely dependent on the strength of the leather.

2. The use of hollow backs throws all the strain of opening and shutting on the joints, and renders the back liable to come right off if the book is much used.

3. The leather of the back is apt to become torn through the use of insufficiently strong headbands, which are unable to stand the strain of the book being taken from the shelf.

4. It is a common practice to use far too thin leather; especially to use large thick skins very much pared down for small books.

5. The leather is often made very wet and stretched a great deal in covering, with the result that on drying it is further strained, almost to breaking point, by contraction, leaving a very small margin of strength to meet the accidents of use.

In order to avoid the constructional defects noticed it is suggested that some such binding as set forth in the first specification is suitable for large and heavy books.

There is nothing new in this form of binding which is only a return to the methods in general use up to the end of the last century. The investigations of the Sub-Committee have led them to think that these methods are far better than those now in common use. While advocating such a binding for valuable or heavy books, the Committee recognise that for the majority of books in most libraries such a method would be too expensive. For octavo and smaller books the Committee is of opinion that some method of binding should be adopted that will allow of the use of much thicker leather than is now common, and will at the same time allow the book to open freely and be generally strong, and not be more expensive than the form of binding now in general use. To meet these requirements the Committee have had the second specification

and two sample bindings prepared shewing the proposed method of construction. The points of advantage claimed by such a binding for library use are :—

- (1.) It need not be expensive.
- (2.) The construction is sound throughout.
- (3.) A book so bound should open well.
- (4.) Much thicker leather than usual could be used. In the absence of raised bands there is no reason for the undue stretching of the leather in covering.
- (5.) The backs of the sections are not injured by saw cuts.

#### SPECIFICATION FOR BINDING HEAVY OR VALUABLE BOOKS.

*Sheets and Plates.*—All sheets broken at the back to be made sound with guards. Any single leaves or plates to be guarded round adjoining sections. Folded plates to be guarded with linen at folds. No pasting-on to be allowed.

*End Papers.*—End papers not to be pasted on or overcast, but to be made with stout linen joint and sewn on as a section. Some system of folding or zigzagging which allows a little play without danger of breaking away is advocated. End papers to be made of good paper.

*Sewing.*—Sewing to be flexible, round the bands and all along the section. Thread to be unbleached linen, and bands to be of stout hempen cord and at least five in number.

*Boards.*—To be of best black millboard. The edge of the millboard in the joint to be slightly rounded, instead of perfectly sharp as at present. The sharp edge sometimes cuts the leather.

*Lacing in Slips.*—All five slips to be laced into each board and not reduced unduly. It would be better to sink places in the board to receive the slips than to weaken them by injudicious fraying out.

*Cutting.*—This will depend on the librarian's orders.

*Headbands.*—Headbands to be worked on stout cord, vellum, or catgut, with very frequent tie-downs, and to be firmly set with stout brown paper, linen or leather.

*Lining up.*—If it is necessary to line up the back it is best done with leather or linen, leather for preference.

*Covering.*—Leather not to be unduly pared down and not made very wet before covering. Care to be taken not to stretch the leather more than necessary. No hollow backs to be used, but the leather to be attached to the back.

*Leather.*—See report of Sub-Committee.

*Handles for Pulling Out of Shelf.*—In the case of very large books that are likely to be much used, it is advisable to have a strap of leather going loosely across the back and each end fastened to a board of the book. The Sub-Committee saw some such arrangement at one or two of the libraries visited, and it seemed that a great saving of the binding resulted from the use.

*Note.*—That manuscripts on vellum, or books of special value will, of course, require special bindings designed to meet the special conditions.

#### SUGGESTED SPECIFICATION FOR ORDINARY LIBRARY BINDING.

*Sheets and Plates.*—All sheets broken at the back to be made sound with guards, any single leaves or plates to be guarded round adjoining sections. Folded plates to be guarded with linen at folds. No pasting-on to be allowed.

*End Papers.*—To be of good paper sewn on. No pasting-on or overcasting to be allowed.

*Sewing.*—To be sewn on not less than four unbleached linen tapes, with unbleached linen thread of suitable thickness. Books to be glued up and backed in the ordinary way, or left square.

*Boards.*—To be made "split boards" like those the vellum binders use. Straw board lined with a thin black board liner.

*Cutting or Treatment of Edges.*—To depend on orders.

*Attaching Slips.*—Slips to be pasted on to waste end papers which should be cut off about two inches from the back and inserted with slips in the centre of split board. The board to be left about 1-8th inch from the back of the book to form a French joint.

*Head-binding.*—Headbands to be worked on round cord or gut with frequent tie-downs, so as to be able to bear the strain of the books being taken from the shelf, or in cases where the expenses of a worked headband is thought to be too great, a piece of string may be inserted into the fold of the leather at the head or tail.

*Covering.*—Leather not to be unduly pared down. The French joint should make it possible to use far thicker leather than is usual. As there are no raised bands on the back the leather need not be unduly stretched in covering. For small books leather from comparatively small skins that will need but little paring should be selected.



[Samples of books bound in accordance with this last specification were prepared for the inspection of the Committee, and received their approval.]

## APPENDIX II.

### REPORT OF SUB-COMMITTEE NO. II. (Scientific.)

Dr. J. Gordon Parker. Prof. H. C. Procter.  
A. Seymour-Jones.

In presenting this Report, we may state that its recommendations are based not only on considerable practical experience, but on a very large amount of careful experimental work, carried out for the purposes of this enquiry. For this purpose a chemical examination was made of a number of samples of perished leather bindings, and an experimental investigation was also made, both on rough and finished skins, supplied by manufacturers, and on those tanned and finished under our own supervision for the special purpose of the enquiry.

This Report is arranged under the following main heads:—

1. Nature of the Decay.
2. Preparation of Leathers suitable for Binding.
3. Bookbinding.
4. Preservation of Books.
5. General Conclusions.

#### 1. NATURE OF THE DECAY.

The most prevalent decay noticed is what we will call the red decay. This, for convenience we will divide up into two periods—old and new, the old red decay being noticeable up to somewhere about 1830, and the new decay, possibly slightly different in character, since that time. The character of the old red decay is of a darkening of the fibres of the leather, that while leaving the surface fairly hard—not easily abraded by friction—renders the leather hard and brittle throughout. The fibres of such leather are found on examination with the microscope to be in a natural position, although much weakened.

This form of decay is specially noticeable in books bound in calf that has presumably been tanned with oak bark.

The new red decay affects nearly all leathers and, in extreme cases, seems absolutely to destroy the fibres.

Another form of deterioration, though not nearly so universal, renders the grain of the leather liable to peel off when exposed to the slightest friction. This is sometimes noticeable in the old period, generally without red decay, in the case of sheepskin and accompanying red decay in the case of calf. In modern leathers, since about 1830, the peeling of the grain is more common, and in quite modern leathers, subsequent to about 1860, it is one of the commonest forms of decay noted, especially in the case of grained morocco and sheepskin. It was also noticed in coloured and grained pigskins; although in this case the texture of the leather was so weakened by its treatment in the tannery that the Committee had great difficulty in believing that it was genuine and not merely a sheepskin imitation, until it was submitted to careful microscopic examination.

In nearly all samples of Russia leather examined, a very violent form of red decay, possibly peculiar to this leather, was noticed. This leather, in most of the cases examined, was found to be absolutely rotten in all parts exposed to light and air; so that on the very slightest rubbing with a blunt instrument, the leather fell into fine dust.

In many cases, and especially in the case of Russia leather, it was reported by librarians that leather on books that were in constant use lasted very much better than that on those that rarely left the shelves. An exception to this was noted in the case of the Patent Office Library where nearly all the books, though very much handled, were, as to leather, in a very bad state. But this may possibly be partly accounted for by the fact that until about three years ago the books were kept in ill-ventilated rooms that were much used, and where very large quantities of gas were burned.

#### 2. PREPARATION OF LEATHERS SUITABLE FOR BINDING.

Without entering into full detail of the experiments which were carried out, we may say that we have arrived at the following conclusions:—

##### RAW SKINS.

We are of opinion that no special skin can be condemned in its original condition, although goat, seal, pig, and calf are probably superior in strength of texture to sheep. Sheepskins are, however, equally resistant to chemical agencies, and being naturally soft and flexible, are extremely suitable for use for purposes where



they are not much exposed to mechanical wear.

#### CURE.

Fresh market skins, dry skins, or wet salted skins are much to be preferred to those known as "drysalted," since the crystallisation of the salt which takes place in the dry-salting process, tends to weaken the structural fibre of the pelt. No tainted or putrid skins, even if only slightly affected, are suitable for the manufacture of bookbinding leather, both for the same reason, and because the weakness of grain so produced leads to uneven dyeing.

#### SOAKING.

In the soaking of skins we would strongly condemn the use of old putrid soaks, or the addition of salt to the soaks to assist in the softening, as both methods weaken the skin. We would recommend, in preference, a plentiful change of fresh water, and in the case of obstinately hard skins the addition of sulphide of sodium to the extent of two parts per thousand to the soak water. Violent mechanical treatment such as "stocking" is injurious, but moderate drumming with cold or tepid water may be permitted.

#### LIMING.

The liming should be done in mellow, weak limes. Old limes smelling strongly of ammonia, and containing large quantities of bacteriological products, must be avoided. The addition of small quantities of sodium sulphide or arsenic sulphide to the limes is often advantageous, and shortens the time required.

Special care should be taken with regard to the beam-house work after unhairing and fleshing, as by excessive or unsound puering and drenching of the skins, their whole natural strength is frequently destroyed. We have examined many samples of leather, both on and off books of recent manufacture, of which the decay has been due to improper beam-house work. Great damage is frequently caused by the use of foul puers or foul bates, in which putrefaction has taken place.

Attention may be drawn to a bacterial substitute for the uncertain dung bate which has recently been put on the market, under the name of Erodine, and which has for some considerable time been used with great success in several works at home and abroad. After experimenting somewhat extensively with this substance, we are strongly

of the opinion that this process of puering is very much safer, and is to be recommended in preference to the old method, than which it is not more expensive. In principle it consists of a suitable nutriment for a pure culture of bating bacteria, which is supplied with it.

#### TANNING.

The vegetable tanning materials now used in the production of leather are very varied, and probably their active principles, the tannins, form a considerable class. Though their chemical constitution is still only partially understood, it is known that they may be divided into two groups, one of which contains the dihydric phenol *catechol*, and the other the trihydric phenol, *pyrogallol*, and these groups are characterised by very considerable practical differences. The catechol tannins, which include quebracho, gambier, larch, hemlock, mimosa, and turwar (*Cassia auriculata*) barks, part readily with water when exposed to the action of light, heat, and acids, becoming converted into red resin-like products. We have found that leathers tanned with these materials, although originally strong and tough, are particularly prone to a sort of red decay, which is much hastened by the presence of acids and the action of light, heat, and gas-fumes, and which totally destroys the tenacity of the leather. After a very large number of experiments, we most unhesitatingly condemn all these catechol tannages for bookbinding and upholstery, however suitable they may be for other purposes.

This brings us to the consideration of the many thousands of skins which come over from India tanned with turwar bark. These are bought on the London markets by the leather dressers, and are usually detanned by scouring, or drumming in an alkaline solution, next treated with sulphuric acid to brighten their colour, and retanned in sumach, after which they are finished, and are usually sold under the name of "Persian moroccos" or "Persian sheep." For cheap bookbinding purposes this leather has been used most extensively, and in all our numerous investigations no leather has proved so inferior in resistance to decay as the re-tanned Persian. A book bound in Persian morocco or in Persian sheep shows signs of decay in less than twelve months, and from our experiments we are inclined to believe that no book bound in these leathers, and exposed in a library on shelves, where it could be affected either by the sun's

rays, or by gas fumes, could ever be expected to last for more than five to seven years. The leather, as imported, will redden perceptibly with a single day's exposure to sunshine! In visiting numerous libraries, we found that more than half the modern bound books which were in a bad state of decay had been bound in Persian or East India-tanned goat and sheep. We cannot emphasise our opinion too strongly on this subject. We should unhesitatingly advise that in all contracts and specifications for bookbinding, the use of East India-tanned goat and sheep, whether re-tanned or not, be absolutely forbidden. Similar objections apply with almost equal force to the use of mimosa, hemlock, or larch, or of quebracho wood or extract, as tannages for bookbinding leathers. Gambier is also objectionable, while oak-bark, valonia, and oakwood extract, which probably contain tannins of both groups, have proved tolerably permanent.

The pyrogallol class of tanning matters which comprises gallnuts, sumach, myrobalans, and pomegranate rind, has proved to yield leathers much more resistant to decay under library conditions than the catechol tannins, and of all these pure sumach is the tannage we would most strongly recommend for high-class bookbinding. We have tested leathers tanned with every common tanning material as regards resistance to the action of light, heat, gas fumes and oxidising agents, and none has stood the test so well as pure sumach tannage. It is almost certain that all the early Italian moroccos which have shewn such remarkable permanence are of sumach tannage, and the Niger goat skins are either tanned with sumach or some closely allied substance. The sumach which is imported into this country is very frequently mixed with cheaper materials such as "tamarix" and "pistacia." When one or both of these materials are present in the sumach, the effect makes itself apparent on the finished material by reducing its length of life, as both these adulterants belong to the class of catechol tannins, which we have unhesitatingly condemned.

It must be clearly understood that our condemnation of the catechol tannins refers only to leathers expected to withstand the action of light and air for long periods, and protected from weather. In resistance to wet and mechanical wear, many catechol tannins are superior to sumach.

The tannage of bookbinding leathers must be a mellow one, and must not be carried too

far, as we have found in many cases the cause of decay in tanned leather has been the fact that the leather was overloaded with tannin. Tanning has throughout a hardening effect on the leather fibre, which, if pushed too far, ends in brittleness and loss of tenacity. We have tested many samples of old leather which are still in a good state of preservation, and find that in each case the percentage of tanning matters present is smaller than the amount which is generally found in most modern leathers. The use of acids, and especially of mineral acids, to assist in producing fullness or plumpness in the skins in the tanning process must be absolutely avoided.

After tanning, the goods should be washed up by merely drawing through clean water to remove any adhering tan liquor, and then laid in pile to drain into semi-dry condition. After oiling on the grain side, they may be dried out, after which process they should on no account receive any more tanning in any subsequent operation. Any additional mellowing effect required should be attained when dried after dyeing, either by suitable application of a non-acid oil or fat-liquor, or by softening on a table by means of the slicker or boarding.

#### FINISHING.

Shaving, if done at all, should only be to a limited extent, since, however it may be carried out, it necessarily weakens the skin by removing its toughest parts, and, therefore, for small books, thin skins should be chosen, so as to avoid the necessity of paring down, while for larger ones a larger and stouter skin may be used. Librarians and bookbinders must realize that they cannot have a large, thin skin which will last, since the thin substance can only be secured by shaving (or splitting, which is still more weakening). If this rule is followed, then the shaving is reduced to simply "necking" and "backing," to equalise the thickness of different parts, and to remove loose adhering flesh.

We do not approve of the method of drying skins tacked out tightly on boards, as the object should be to retain the fibres in their naturally felted and sinuous condition. If the skins are shaved, they are stretched out in the operation, and the fibres get laid flat and straight, and this condition is subsequently increased in the wet-setting out, and finally permanently fixed by drying tacked out on the board. This horizontal position does not admit of any play or elasticity in the fibres, which is especially necessary in that part of



the book which forms the hinge between the back and the side. Again, if the fibres are retained unstretched, they form a sort of elastic cushion, and wear only on the surface, and as the surface layer contributes little to the strength of the leather, the injury even after many years is inappreciable. If the fibres are in a state of strain, they present a horizontal surface to the back and sides of the book, and the wear comes upon the side of the fibres which give way and break successively.

These statements are supported by the fact that much of the leather which is at present in good condition on old books was manufactured before the introduction either of the slicking, shaving, or setting-out tools, and microscopic examination of this leather reveals the fact that its fibres are in a much more erect condition than those in modern leather. In further confirmation, several skins were tanned, and portions of each were finished differently, and it was found that those which had not been severely stretched had greater strength, greater pliability and durability than the leather from the same skin which had been tightly set out, shaved, and dried in the strained condition, as is common in modern leather manufacture. For similar reasons the embossing of leathers by heavy pressure under plates and rollers must be condemned for all good work, not only as artistically a sham, but as actually injuring the texture of the leather. Where a grained or "pebbled" surface is required it should be that natural to the skin employed, and merely developed by the process of "boarding."

#### DYEING AND FINISHING.

We cannot condemn any special group of dye-stuffs, but manufacturers must select those which are fastest to light and air, and which can be applied without the use of strong acids or dangerous mordants. Many of the coal tar colours answer this test, as do some of the wood dyes. But, on the other hand, very many colours, both natural and artificial, are absolutely fleeting to even short exposure to light, and others can only be applied by the use of methods injurious to the leather. It is desirable that a supplementary report should be made on the selection of dyes.

We must absolutely condemn the use of any but mild vegetable acids in souring or scouring the leather, or in the dye bath, and as far as possible would avoid the use both acids and alkalis on tanned leather, both being equally injurious.

It has been shown by careful experiment, that even a minute quantity of sulphuric acid used in the dye bath to liberate the colour, is at once absorbed by the leather, and that no amount of subsequent washing will remove it. In a very large proportion of cases the decay of modern sumach-tanned leather has been due to the sulphuric acid used in the dye bath, and retained in the skin. We have examined very many samples of leather manufactured and sold specially for bookbinding purposes, from different factories, bought from different dealers, or kindly supplied by bookbinders and by librarians, and have found them to contain, in a large number of cases, free sulphuric acid, from 0.5 up to 1.6 per cent.

We have also manufactured leathers with and without the use of acid, and have exposed these leathers to different tests side by side. In each case the sample treated with acid has decayed within a very short time.

Metallic salts of mineral acids should as a rule be avoided as mordants, and the use of bichromate of potash, or sulphate of iron for dulling colours must for similar reasons be absolutely condemned. Iron salts are always injurious to leather, but if used at all, those of weak organic acids (acetates, lactates, &c.) are least objectionable. Some of the old blacks produced with iron dissolved in sour beer, cider, or vinegar have lasted well, but iron-logwood blacks are never permanent. Several aniline blacks are fairly fast and do not injure leather.

The skins on leaving the dye bath should be well rinsed to free them from excess of dye, and then finished. If mineral acids must be used in clearing or dyeing, the addition of a little acetate, lactate, tartrate or citrate of soda or potash to the washing water lessens the risk of future decay. We make no special recommendations in finishing, except that a tight setting out of the fibres must in all cases be avoided. The staking, perching and graining may be carried out, as is usual. We should, however, advise that the glazing of skins by friction in a damp "seasoned" condition should be avoided.

Simple seasonings containing either blood or egg albumen, Iceland moss, or other similar mucilages, may be used, but no strong acids or alkalis must ever enter into their composition. The use of nitric acid as a preparation for glazing is absolutely destructive.

When glazed and re-grained, the skins may be lightly oiled over with an oil free from acid, and they are then ready for the bookbinders' uses.



## 3. BOOKBINDING.

We leave the mechanical art of bookbinding to other members of the Committee, but there are several chemical points which we must touch upon. The use of oxalic acid for washing backs of books, or of leather for bookbinding, is fatal to their durability. Vinegar, even in its pure state, is injurious, but many bookbinders use a very crude wood-vinegar, containing tarry products, which make its use still more detrimental to the leather. The presence of sulphuric acid in the vinegar used should be guarded against.

The sprinkling of leather, with ferrous sulphate (green vitriol), either for the production of "sprinkled" calf or "tree" calf, must be most strongly condemned, as the iron combines with and destroys the tan in the leather, and free sulphuric acid is liberated which is still more destructive. Iron acetate or lactate is somewhat less objectionable, but probably the same effects may be obtained with aniline colours without risk to the leather.

The egg-glaires used by bookbinders certainly tend to preserve the leather from external atmospheric influences. It is, however, a debatable question whether the glaire does not interfere with the pliability of the leather at the joints, and at the portion of the leather which bends when the book is opened. This also applies to the use of resinous varnishes as preservatives.

We have examined samples of the pastes which are used by bookbinders, and have not found anything which would be likely to be detrimental to the skins; but it is important that the paste should be used in a fresh condition, otherwise it is liable to undergo an acid fermentation, and to favour the growth of injurious moulds and bacteria.

The stretching of leather tightly over books in a wet condition has the same bad effects as drying nailed on boards, but in an almost greater degree, and should be strongly condemned.

## 4.—PRESERVATION OF BOOKS.

Much light has been thrown on the influence of various outside conditions existing in libraries on the durability of leather, by a series of very careful experiments made by the Committee. These experiments prove conclusively that the acid fumes of burnt gas are the most fatal of all the influences to which bindings are ordinarily exposed, producing what has been described as "red decay," on every sort of leather to which they have had access, the effect being most marked on the East India tannages, and

other leathers made with tannins of the catechol class; and least so upon these with sumach, and other tannins such as myrobalans, which are known to be pyrogallol derivatives, while oak-bark occupies an intermediate position, both practically and chemically. It was shown that 30 days' exposure to the fumes of a very small gas jet rendered East India leather (tanned with turwar bark) perfectly rotten, so that the surface could be scraped off with the finger nail, while on leather tanned with sumach it had comparatively little effect. Similar experiments were made with exposure to sunlight during 30 days of the past summer, and in this case again, the leathers were affected in the same order; turwar, quebracho, larch bark, and gambier being among the worst; and sumach and myrobalans the least affected, while oak-bark as before occupied an intermediate place, being somewhat darkened but comparatively little tendered. It was found that serious effects, very similar to those of light, were produced by exposure during 30 days to air at a temperature not exceeding 110° to 120° Fahr., dry air being apparently slightly the most deleterious.

Some attempts have been made to determine the effect of light transmitted through glasses of different colours, and they point to the fact that blue and violet glass pass light of nearly as deleterious quality as white glass; while leathers under red, green, and yellow glasses were almost completely protected. These statements are true not only of East Indian tanned skins but of those tanned with sumach, but the latter were much less affected, even by the blue, white, and violet light, again demonstrating the greater power of resistance of sumach tannage. There can be no doubt that the use of pale yellow or olive-green glass in library windows exposed to direct sunlight is desirable. A large number of experiments have been made on the tinted "cathedral" glasses of Messrs. Pilkington Bros., Limited, with the result that Nos. 812 and 712 afforded almost complete protection during two months' exposure to sunlight, while Nos. 704 and 804 may be recommended where only very pale shades are permissible. The glasses employed were subjected to careful spectroscopic examination, and to colour-measurement by the tintometer, but neither were found to give precise indications as to the protective power of the glasses, which is no doubt due to the absorption of the violet, and especially of the invisible ultra-violet rays. An easy method of comparing glasses is to

expose under them to sunlight the ordinary sensitised albumenised photographic paper. Those glasses under which this is least darkened are also most protective to leather.

Experiments made by exposure to artificial light from both ordinary and incandescent gas burners and from incandescent electric lamps during 30 days show marked darkening, but it may be questioned whether the effects observed were not partially due to the radiant heat, and further investigations are in progress. Attempts made to decide whether the darkening effects observed were due to oxidation, by exposing samples to oxygen, air, and carbon di-oxide, and in a good but not perfect vacuum, proved inconclusive, light, warmth, and moisture having apparently more influence than oxygen.

The effect of ammonia vapour, and tobacco fumes, of which ammonia is one of the active ingredients, were also examined. The effect of ammonia fumes was very marked, darkening every description of leather, and it is known that in extreme cases it causes a rapid form of decay. Tobacco smoke had a very similar darkening and deleterious effect (least marked in the case of sumach tanned leathers) and there can be no doubt that the deterioration of bindings in a library where smoking was permitted and the rooms much used, must have been partly due to this cause.

Tests were made with the Niger red goat-skin now so largely used for high-class book-binding, by exposure to light, air, gas fumes, and dry heat, by none of which it seems to be much affected, and the opinion of the book-binders is confirmed, that it is one of the most durable tannages. It is probably tanned with sumach or some closely allied material. The nature of the dye has not been definitely ascertained.

#### 5.—SUBSTITUTES FOR LEATHER IN BOOK-BINDING.

We have examined several materials proposed as substitutes for leather for book-binding. We find that they are not so durable as properly prepared leather, but last longer than "Persians" or improperly prepared leather.

#### 6.—GENERAL CONCLUSION.

To sum up the experimental work as far as it has gone :—

1. It is shown conclusively that the catechol tannins, which include turwar, quebracho, hemlock, and larch barks, and gambier, are unsuitable for bookbinding leathers where durability is expected, and that sumach yields a much more permanent leather, while myro-

balans occupy an intermediate place, but nearly approaching sumach. It is unfortunate that *cassia* bark, which is the tanning material employed for East Indian sheep and goatskins, should have proved so unreliable, since these leathers have been largely used in bookbinding without suspicion, and are in other respects a cheap and good article. With regard to sumach leathers themselves, it is possible that some of the darkening noticed may be due to the presence of adulterants, such as pistacia leaves, in the sumach used, as it is almost impracticable to obtain absolutely pure sumach, and the pistacia tannin is allied to that of the *cassia*.

2. Of all the influences to which books are exposed in libraries, gas fumes—no doubt because of the sulphuric and sulphurous acid which they contain—are shown to be the most injurious, but light, and especially direct sunlight and hot air, are shown to possess deleterious influences which had scarcely been suspected previously, and the importance of moderate temperature and thorough ventilation of libraries cannot be too much insisted on.

The Sub-Committee reserve their report on the durability of colours applicable to the dyeing of leather, very few of which are entirely unaffected by light and air. Experience has shown that books which are handled frequently are preserved by the slight amount of grease which they receive, and the Committee hope, in a subsequent report, to be able to suggest a suitable dressing to be applied for this purpose. The suitability of such a material can only be decided by experiments extending over some months.

### APPENDIX III.

#### HINTS TO OWNERS AND KEEPERS OF LIBRARIES.

By the Chairman of the Committee.

The following suggestions may, perhaps, be found useful, especially to the owners of private libraries. There is no novelty in them, but the rules inculcated are too commonly neglected, and much injury to books thereby caused :—

1. Rooms in which books are kept should not be subject to extremes, whether of heat or cold, of moisture or dryness. It may be said that the better adapted a room is for human occupation, the better for the books it contains. Damp is, of course, most mischievous, but over-dryness induced by heated air, especially



when the pipes are in close proximity to the book-cases, is also very injurious. The bad effect of the fumes of burnt gas and tobacco has been dwelt upon in the Report. Good ventilation is a palliative of these evils; glass cases also, as has been pointed out, are a valuable protection to books, but they are expensive, and books stored in them lose much of their decorative effect, and are not very accessible.

2. Dust should not be allowed to accumulate on books or in book-cases, for hygienic reasons. But dust, especially in conjunction with damp, is injurious also to books, and should be frequently removed. Besides this indispensable precaution, books should be taken down from the shelves at least once a year, opened, and left for some hours before being replaced. The mischief done in private libraries by careless housemaids employed on this work as a part of the "spring cleaning" is incalculable. The books are ruthlessly pulled out by the top edges of their backs, violently slammed to expel the dust, frequently dropped, and invariably misplaced on their return to the shelves. In small and valuable libraries the work is best done, and no doubt often is done, by the owner. In large libraries an intelligent man with some respect for books should be specially employed. Dust may to a considerable extent be kept out by leather vallances.

3. It is important that a just medium should be observed between the close and loose disposition of books in the shelves. Tight packing causes the pulling off of the tops of book-backs, injurious friction between their sides, and undue pressure, which tends to force off their backs. But books should not stand loosely on the shelves. They require support and moderate lateral pressure, otherwise the leaves are apt to open and admit dust, damp and mildew. The weight of the leaves also in good-sized volumes loosely placed will often be found to be resting on the shelf, making the backs concave, and spoiling the shape and cohesion of the books.

In libraries where classification is attempted there must be a certain number of partially filled shelves. The books in these should be kept in place by some such device as that in use in the British Museum, namely, a simple flat angle piece of galvanised iron, in the lower flange of which the end books rest, keeping it down, the upright flange keeping the books close, and preventing them from spreading.

4. Great care should be exercised when

book-cases are painted or varnished that the surface should be left hard, smooth, and dry. Bindings, especially those of delicate texture, may be irreparably rubbed if brought in contact with rough or coarsely painted surfaces, while the paint itself, years after its original application, is liable to come off upon the books, leaving indelible marks. In such cases pasteboard guards against the ends of the shelves are the only remedy.

5. Persons who care for the appearance of their books should take particular note of the condition of their backs and joints. When the joints begin to crack, early treatment is the cheapest and the most efficacious. The main object of all such repairs should be the conservation of the back, as far as possible, in its original state. If it is sound, nothing but skilful patching or re-jointing is needed. But when a back has become structurally unsound, or the surface leather shows signs of decay, it is too commonly the practice to sacrifice the old back and entirely re-back the volume, often to the great detriment of its appearance and value. This, of course, in many cases cannot be avoided, but it is often quite possible to remove the surface leather, re-back the book, and paste on again the old leather, which, unless it is too far gone, will last many years.

Books, especially those in old calf bindings, in many ways benefit greatly by the application to them of some polish. The surface of the leather so treated takes a fine polish very pleasing to the eye and touch; friction is greatly diminished, and the books, even if closely packed, can be taken out with comparative ease. The main object of the treatment should, however, be the preservation of the leather, and there is reason to believe that with some preparations this is not effected, and that the leather is made dry and brittle. It is hoped that the experts upon our Sub-Committee may be able in their next report to recommend a dressing which will meet all requirements.

COBHAM.

#### APPENDIX IV.

##### CIRCULAR TO LIBRARIANS AND REPLIES.

The following circular letter was sent to Librarians:—

*September, 1900.*

DEAR SIR,

In consequence of the widespread feeling of dissatisfaction among those interested in the care of books respecting the perishable nature of certain leather used for bookbinding, the Council of the Society of



Arts were moved to institute an investigation into the character of the evil, and the best means of remedying it. An influential Committee has been appointed to consider the whole question and report to the Council.

Two Sub-Committees are also at work. One has undertaken to visit libraries, and to collect evidence as to the perishing of modern leather as compared with that formerly used; and another Committee has undertaken to report on the manufacture of leather, to investigate the causes of its decay, and, if possible, to suggest remedies.

The Committee, recognising the importance to Librarians of the preservation of books committed to their care, have drawn up a few questions for submission to those specially interested in the subject, and they hope you will give them the benefit of your opinions on the annexed form.

They will also feel much obliged if you will favour them with any further information which you think may assist the Committee, or with any suggestions which your experience may lead you to make.

Yours faithfully,

HENRY TRUEMAN WOOD,  
*Secretary.*

Thirty-nine replies have been received to the following questions:—

- I.—(a) Do any of your leather bookbindings show marked deterioration; and, if so,  
(b) What is, in your opinion, the cause?  
(a) Thirty-one replied yes; two replied no; four were undecided; (b) twenty-one gas; six bad leather.

- II.—What class of leather do you consider the best for bookbinding?

Morocco and pigskin recommended by almost all; cloth by six; calf by three; Russia by one; vellum by three; bark-tanned leather by one; sealskin by one (a member of the Committee); Persian recommended by one and condemned by one.

- III.—What are the conditions of your library as to lighting, heating, and ventilation?

Twenty-eight now use electric light where gas was formerly used; hot water and open fires generally used; ventilation good in twenty cases.

- IV.—Have any regular means been taken to prevent your leather bindings from decaying, by the use of some preservative application?

Twenty-five have not used regular means; four used vaseline; two used cuirine; one (a member of the Committee) used furniture polish.

If you can assist the Committee by giving any further information, or by sending any small samples of decayed leather (with approximate date of binding) it will be esteemed a favour.

The two libraries reporting no serious decay of leather use no artificial light and report the ventilation as being good.

#### LIST OF LIBRARIES SENDING ANSWERS TO THE ABOVE QUESTIONS.

- Arbroath—Public Library.  
Aston Manor—Public Library.  
Birmingham—Central Free Library.  
„ (Margaret-street)—Library.  
Bolton—Public Library.  
Bradford—Public Free Library.  
Blackburn—Free Library.  
Brighton—Public Library.  
Bristol—City Library.  
„ Museum Reference Library.  
Cambridge—Trinity College Library.  
„ Free Library.  
Dublin—National Library of Ireland.  
„ Trinity College Library.  
Glasgow—The Mitchell Library.  
Liverpool—Public Library.  
London—British Museum Library.  
„ (South Kensington)—Board of Education Library.  
„ (South Kensington)—National Art Library.  
„ India Office Library.  
„ Incorporated Law Society Library.  
„ Museum of Practical Geology Library.  
„ Patent Office Library.  
„ Royal College of Surgeons' Library.  
„ Royal Geographical Society's Library.  
„ Royal Statistical Society's Library.  
„ Royal Society's Library.  
„ Society of Antiquaries' Library.  
„ University College Library.  
Manchester—Athenæum Library.  
„ Christie Library, Owen's College.  
Nottingham—Public Library.  
Oxford—Christ Church Library.  
„ Magdalen College Library.  
Penzance—Public Library.  
West Bromwich—Free Library.  
Wigan—Public Library.  
Wolverhampton—Free Library.  
Worcester—Corporation Library.

## REPORT ON LEATHER FOR BOOKBINDING.

	Question I.		Question II.	Question III.		Question IV.
	Yes.	No.	Cause.	Light	Heat.	Ventilation.
Arbroath, Public Library .....	—	—	—	Electric.	Hot water.	—
Aston Manor, Public Library* .....	Yes.	—	Gas.	Electric.	Hot water.	—
Athenæum, Manchester .....	Yes.	—	Gas.	Electric.	Hot water.	Tobin.
Birmingham, Central Free Library .....	Yes (not to any serious extent).	—	Gas (want of ventilation in one room).	Electric.	Hot water.	Good.
Blackburn, Free Library .....	Yes.	—	Gas.	Electric.	Hot water.	Good.
Bolton, Public Library .....	Yes.	—	Bad ventilation.	Electric.	Hot water.	Good.
Bradford, Public Library .....	Yes.	—	Gas fumes from iron forge).	Electric.	Hot water.	Electric fans.
Brighton, Public Library .....	Yes.	—	Gas, heat.	Electric.	Hot water.	Not over good
Bristol, City Library .....	Yes.	—	Gas.	Electric.	Hot water.	Boyles.
British Museum .....	Yes.	—	Gas (bad ventilation).	Gas and e. l.	Hot water.	Imperfect.
Museum Reference Library .....	Yes.	—	Gas (bad ventilation).	Electric.	Hot water.	Tobin.
Cambridge, Free Library .....	Yes.	—	Acid.	Electric.	Hot water.	In roof.
Trinity College Library .....	Yes.	—	Quality of leather.	No.	Good.	—
Dublin, National Libraries of Ireland (formerly) Trinity College .....	Yes (not since) e. l. installed).	No.	Gas.	No artificial.	Hot water.	Good.
Glasgow, Mitchell Library .....	Yes.	—	Gas (Persian Morocco bad).	Electric.	Hot water.	Good.
Incorporated Law Society .....	Yes.	—	Bad calf.	Electric.	Open fires.	Good.
India Office .....	Yes.	—	Heat, cold.	Electric.	Hot water.	—
Kensington (South), Board of Education .....	—	—	Russia bad.	Electric.	Hot water.	Draughtly.
Liverpool, Public Library† .....	Yes.	—	Gas, heat.	Electric.	Hot water.	Good.
Museum of Practical Geology (calf and Russian, worst) .....	Yes.	—	Gas (calf bad).	Electric.	Hot water.	Good.
Nottingham, Public Library .....	Yes.	—	Bad leather.	Electric.	Hot water.	Window.
Owen's College .....	Yes.	—	Gas.	Electric.	Hot water.	—
Oxford, Christ Church Library .....	Yes.	—	Gas (age, damp, heat).	Gas.	Open fires.	—
Patent Office .....	Yes.	No.	Bad leather.	No artificial.	—	Good.
Penzance, Public Library .....	Yes.	—	Bad leather.	Gas.	Hot water.	Good.
Royal College of Surgeons .....	Yes (before e. l. installed).	—	—	—	Open fires.	—
Royal Geographical Society .....	Yes.	—	Gas, smoke.	Electric.	Open fires.	—
Royal Society .....	Yes.	—	Various, Londonair, dryness.	Electric.	Hot water.	—
Royal Statistical Society .....	(No falling off in quality noticed.)	—	Gas.	Gas.	Gas.	No special.
University College, London .....	Yes (all on high shelves).	—	Gas.	Electric.	Steam pipes.	Good.
West Bromwich, Free Library .....	Yes.	—	Gas (chemicals in tannery).	Gas.	Hot water.	Good.
Wigan, Public Library .....	Yes.	—	Gas (chemicals in tannery).	Gas.	Hot water.	—
Wolverhampton, Free Library .....	Yes.	—	Gas.	Electric.	Hot water.	Bad.
Worcester, Corporation Library .....	Yes.	—	Gas, bad leather.	Electric.	Hot water.	Gas.

\* Leather of reddish brown or orange colour the worst. Cloth better for books not used.

† Liverpool reported that leather bindings on books circulated from lending department do not suffer in the least from decay as is the case with so many in reference libraries.